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Description

The AP3417A is a 1.4MHz fixed frequency, current mode, PWM synchronous buck (step-down) DC-DC converter, capable of driving a 1A load with high efficiency, excellent line and load regulation. The device integrates synchronous P-channel and N-channel power MOSFET switches with low on-resistance. It is ideal for powering portable equipment that runs from a single Li-ion battery.

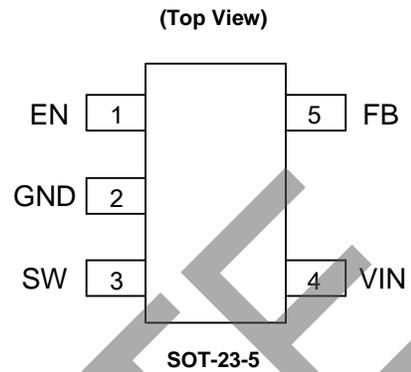
A standard series of inductors are available from several different manufacturers optimized for use with the AP3417A. This feature greatly simplifies the design of switch-mode power supplies.

The AP3417A is available in SOT-23-5 package.

Features

- Input Voltage Range: 2.5V to 5.5V
- Output Voltage: 0.6V to V_{IN}
- ADJ Output
- Fixed 1.4MHz Frequency
- High Efficiency up to 95%
- Output Current: 1A
- Current Mode Control
- 100% Duty Cycle in Dropout
- Built-In Over Current Protection
- Built-In Short Circuit Protection
- Built-In Thermal Shutdown Protection
- Built-In UVLO Function
- Built-In Soft-Start

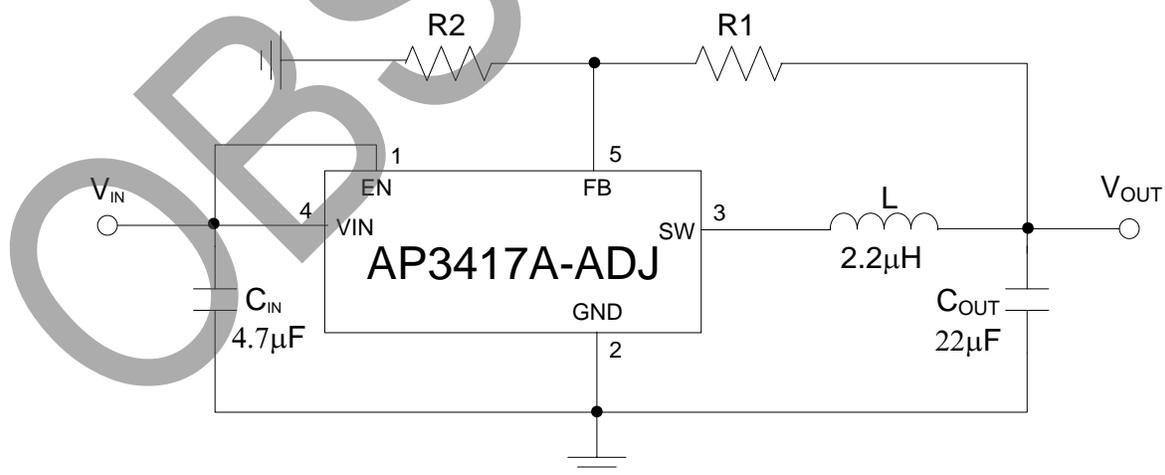
Pin Assignments



Applications

- Set-Top Box
- Datacom
- Portable Device
- Smart Phone

Typical Applications Circuit

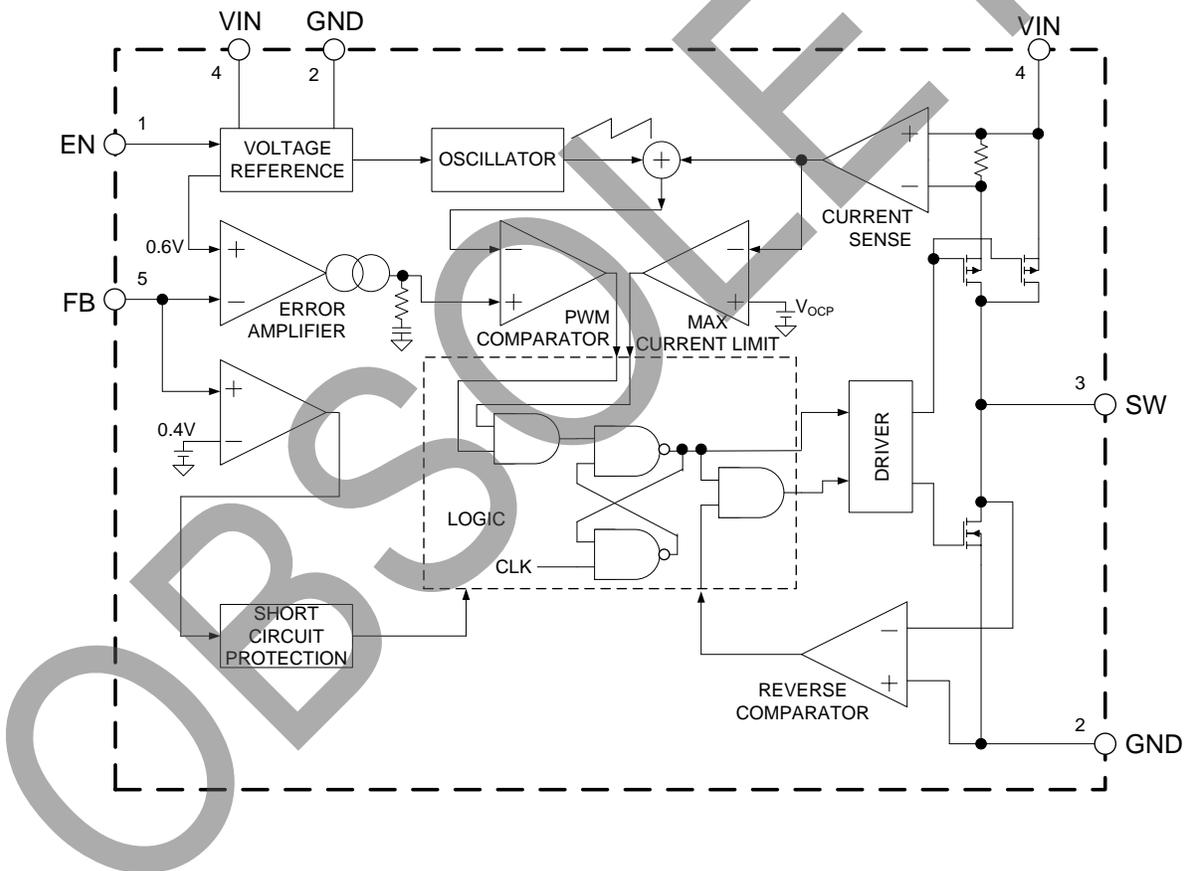


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Pin Descriptions

| Pin Number | Pin Name | Function |
|------------|----------|--|
| 1 | EN | Control input pin. Forcing this pin above 1.5V enables the IC. Forcing this pin below 0.4V shuts down the IC. When the IC is in shutdown mode, all functions are disabled to decrease the supply current below 1µA |
| 2 | GND | Ground pin |
| 3 | SW | Power switch output pin. Inductor connection to drain of the internal PFET and NFET switches |
| 4 | VIN | Supply input pin. Bypass to GND with a 4.7µF or greater ceramic capacitor |
| 5 | FB | This is the feedback pin of the device. Connect this pin directly to the output if the fixed output voltage version is used. For the adjustable version, an external resistor divider is connected to this pin |

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

| Symbol | Parameter | Rating | Unit |
|---------------|-------------------------------------|----------------------|------|
| V_{IN} | Input Voltage | -0.3 to 6.0 | V |
| V_{FB} | Feedback Voltage | -0.3 to $V_{IN}+0.3$ | V |
| V_{EN} | EN Pin Voltage | -0.3 to $V_{IN}+0.3$ | V |
| V_{SW} | SW Pin Voltage | -0.3 to $V_{IN}+0.3$ | V |
| θ_{JA} | Thermal Resistance | 265 | °C/W |
| T_J | Operating Junction Temperature | +150 | °C |
| T_{STG} | Storage Temperature | -65 to +150 | °C |
| T_{LEAD} | Lead Temperature (Soldering, 10sec) | +260 | °C |
| - | ESD(Machine Model) | 200 | V |
| - | ESD(Human Body Model) | 2000 | V |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|----------|-------------------------------|-----|-----|------|
| V_{IN} | Input Voltage | 2.5 | 5.5 | V |
| T_A | Operating Ambient Temperature | -40 | +85 | °C |

Electrical Characteristics ($V_{IN} = 5V$, $T_A = +25^{\circ}C$, unless otherwise specified.)

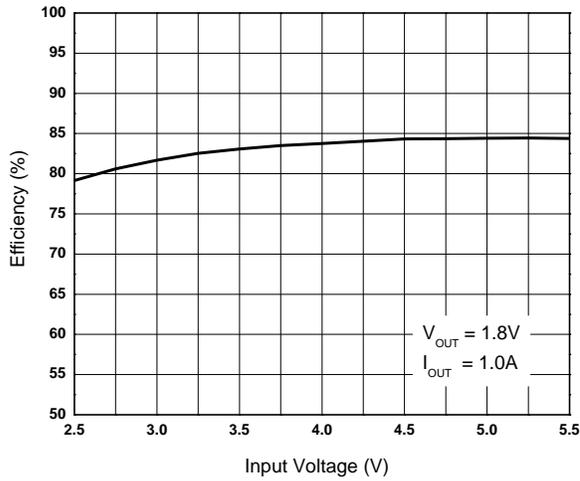
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|-----------------------------|-------------------------------|-------|------|-------|-------------|
| V_{IN} | Input Voltage | – | 2.5 | – | 5.5 | V |
| I_Q | Quiescent Current | $V_{FB} = 0.65V$ | – | 62 | 100 | μA |
| I_{STBY} | Shutdown Supply Current | $V_{EN} = GND$ | – | 0.1 | 1 | μA |
| V_{REF} | Reference Voltage | For Adjustable Output Voltage | 0.588 | 0.6 | 0.612 | V |
| I_{FB_H} | Feedback Bias Current | $V_{FB} = 1V$ | -0.1 | – | 0.1 | μA |
| I_{FB_L} | | $V_{FB} = 0V$ | -0.1 | – | 0.1 | |
| $R_{DS(ON)_P}$ | PMOSFET R_{ON} | $I_{SW} = 200mA$ | – | 0.25 | – | Ω |
| $R_{DS(ON)_N}$ | NMOSFET R_{ON} | $I_{SW} = -200mA$ | – | 0.2 | – | Ω |
| I_{LIM} | Switch Current Limit | $V_{FB} = 0.55V$ | 1.3 | 1.8 | – | A |
| V_H | EN Pin Threshold | – | 1.5 | – | – | V |
| V_L | | – | – | – | 0.4 | |
| V_{UVLO} | UVLO Threshold | V_{IN} Rising | – | 2.3 | – | V |
| V_{HYS} | UVLO Hysteresis | – | – | 0.2 | – | |
| f_{OSC} | Oscillator Frequency | – | 1.12 | 1.40 | 1.68 | MHz |
| D_{MAX} | Max. Duty Cycle | – | 100 | – | – | % |
| D_{MIN} | Min. Duty Cycle | – | – | – | 0 | |
| I_{SW_H} | SW Leakage Current | $V_{SW} = 0V$ | – | 0.1 | – | μA |
| I_{SW_L} | | $V_{SW} = 5V$ | – | 0.1 | – | |
| t_{SS} | Soft-Start Time | – | – | 1 | – | ms |
| T_{OTSD} | Thermal Shutdown | – | – | +160 | – | $^{\circ}C$ |
| T_{HYS} | Thermal Shutdown Hysteresis | – | – | +20 | – | $^{\circ}C$ |

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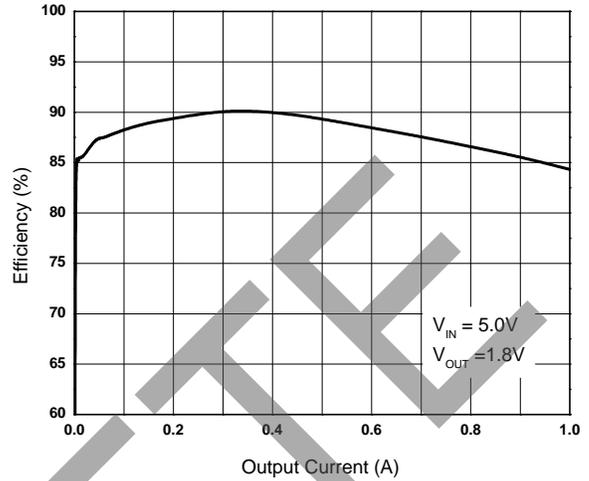
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Performance Characteristics ($V_{IN} = 5V$, $T_A = +25^\circ C$, unless otherwise specified.)

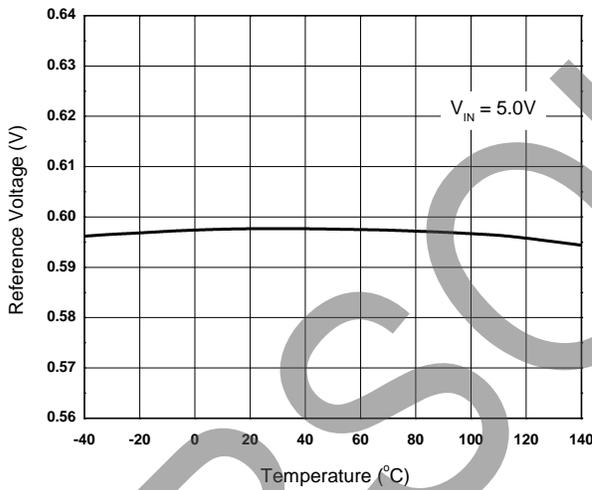
Efficiency vs. Input Voltage



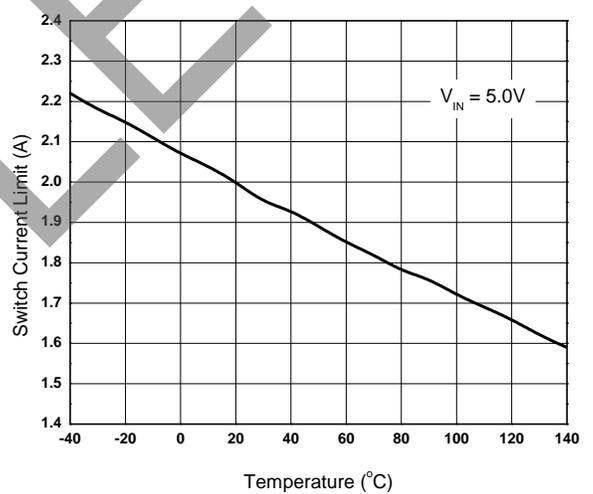
Efficiency vs. Output Current



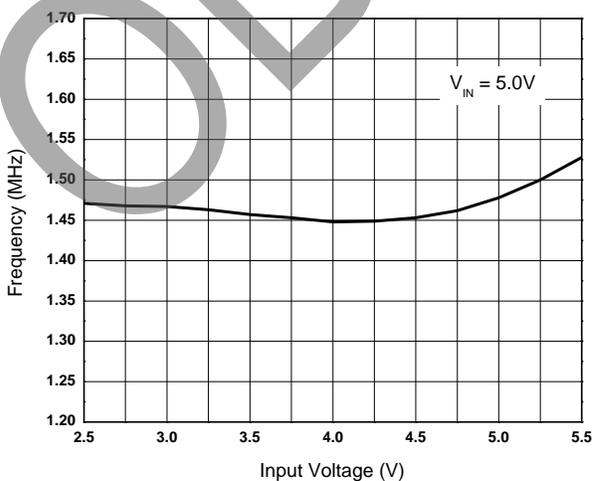
Reference Voltage vs. Temperature



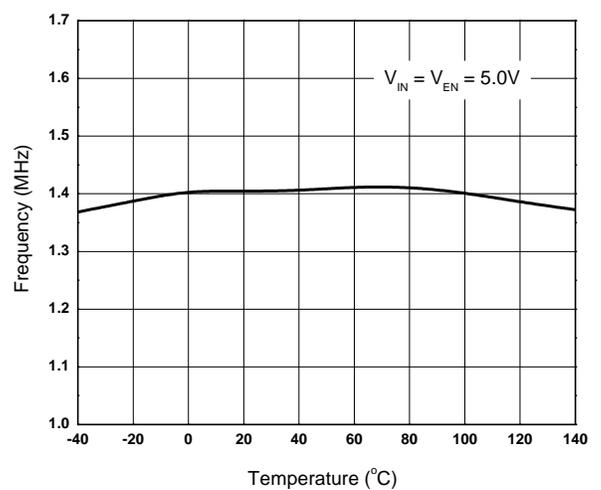
Switch Current Limit vs. Temperature



Frequency vs. Input Voltage



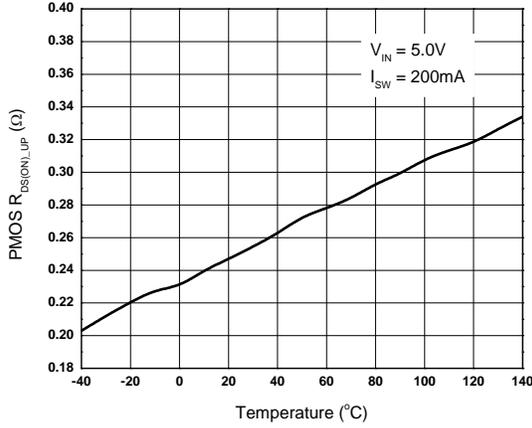
Frequency vs. Temperature



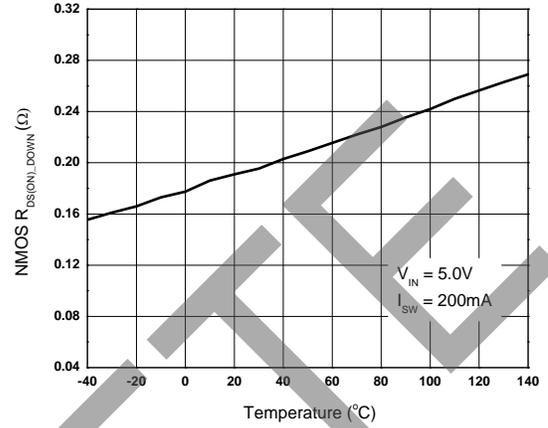
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Performance Characteristics (Cont. $V_{IN} = 5V$, $T_A = +25^\circ C$, unless otherwise specified.)

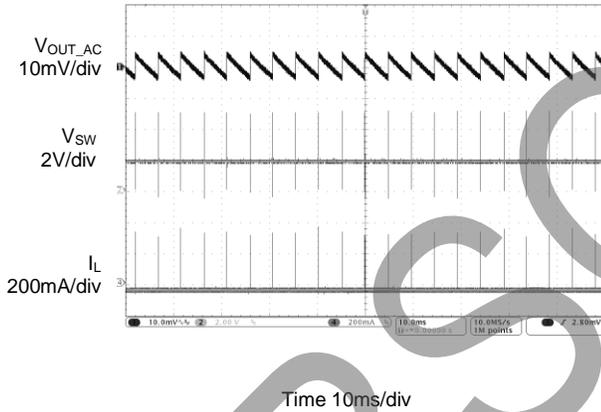
$R_{DS(ON)_{UP}}$ vs. Temperature



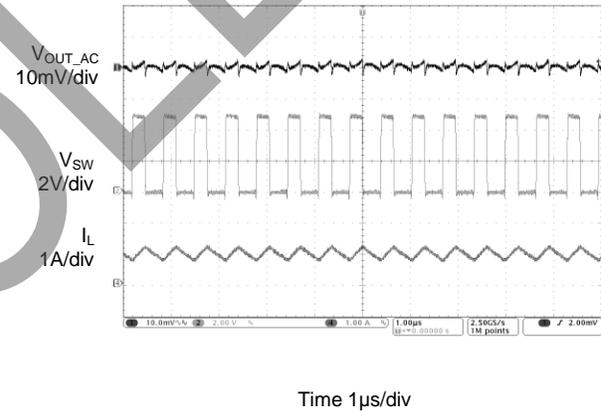
$R_{DS(ON)_{DOWN}}$ vs. Temperature



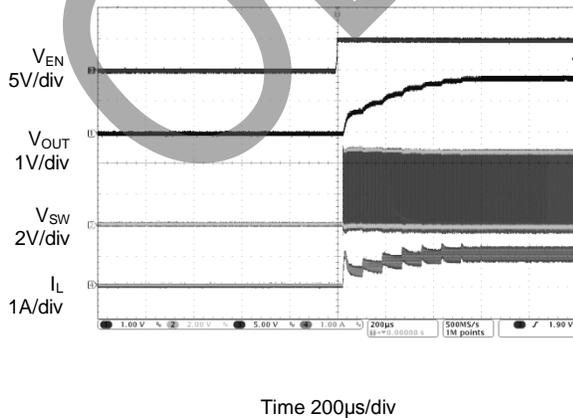
Output Ripple ($I_{OUT} = 0A$)



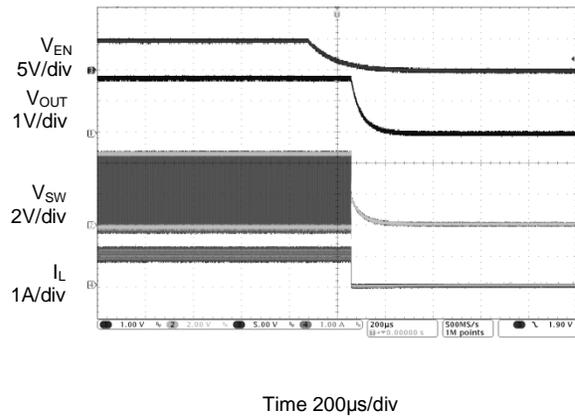
Output Ripple ($I_{OUT} = 1A$)



Enable Turn on ($I_{OUT} = 1A$)



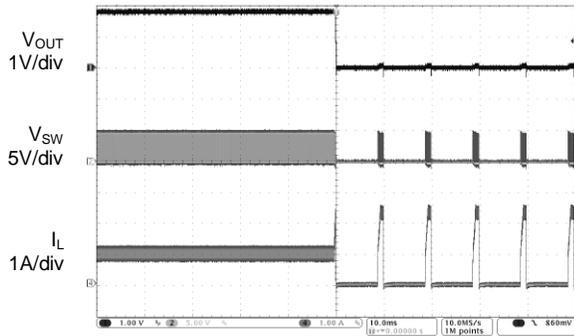
Enable Turn off ($I_{OUT} = 1A$)



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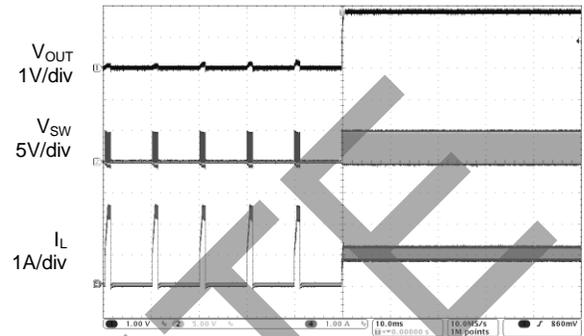
Performance Characteristics (Cont. $V_{IN} = 5V$, $T_A = +25^\circ C$, unless otherwise specified.)

Short Circuit Protection ($I_{OUT} = 1A$)



Time 10ms/div

Short Circuit Protection Recovery ($I_{OUT} = 1A$)

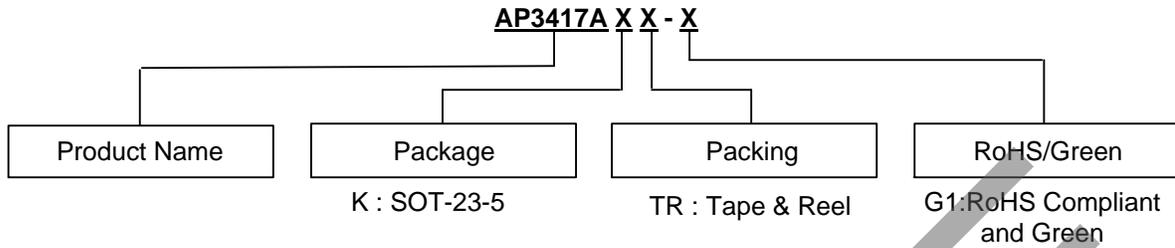


Time 10ms/div

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Ordering Information



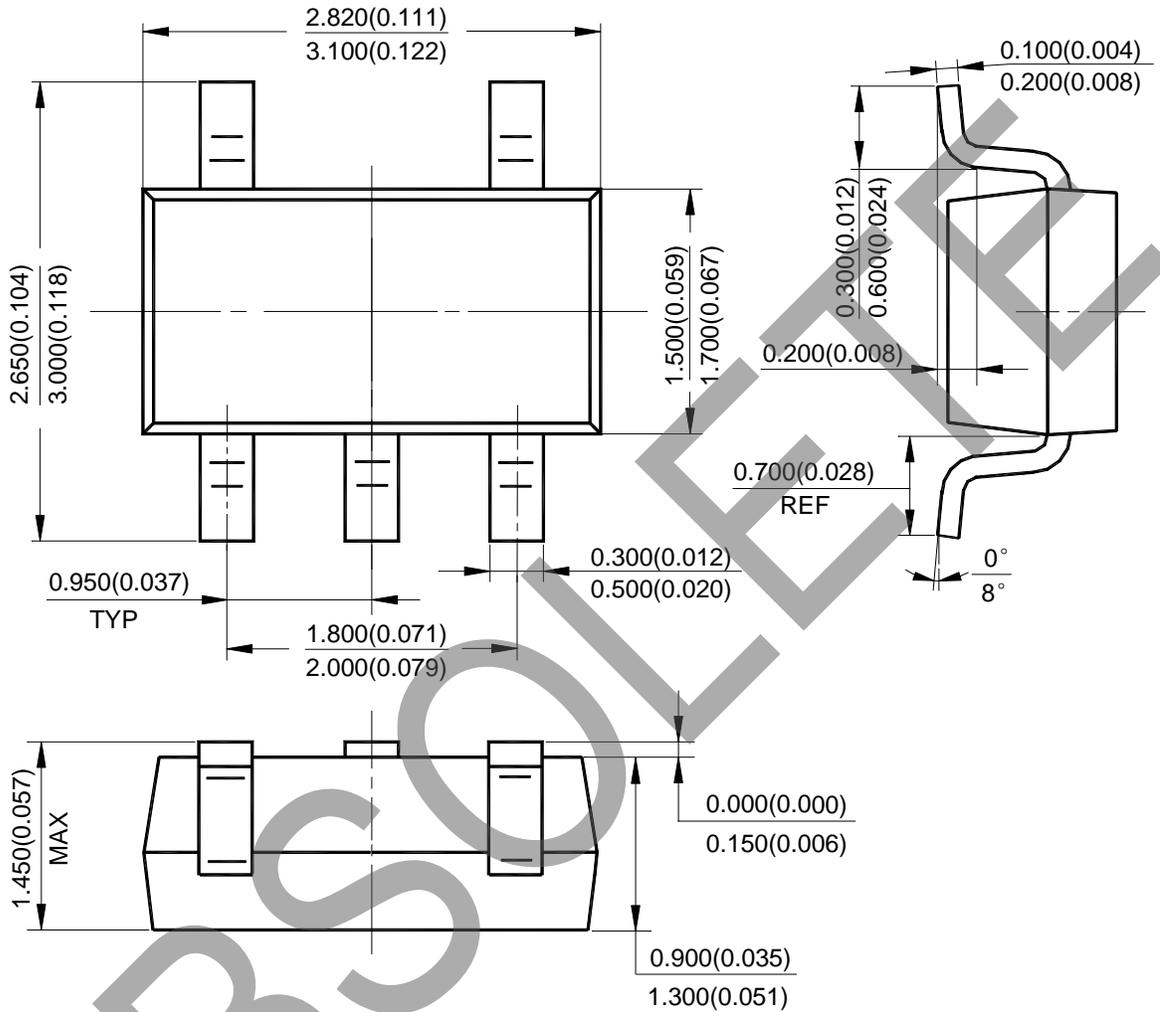
| Package | Temperature Range | Part Number | Marking ID | Packing |
|----------|-------------------|---------------|------------|-------------|
| SOT-23-5 | -40 to +85°C | AP3417AKTR-G1 | G4H | Tape & Reel |

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Package Outline Dimensions (All dimensions in mm(inch).)

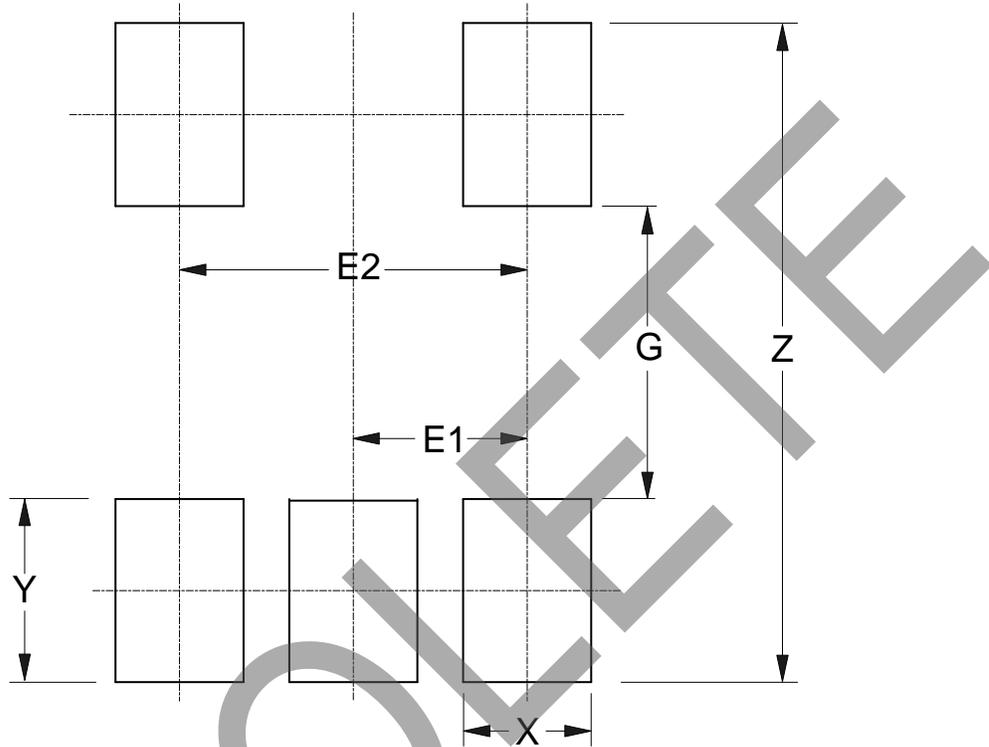
(1) Package Type: SOT-23-5



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Suggested Pad Layout

(1) Package Type: SOT-23-5



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

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